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NCAR Readies for Skylab Role

Boulder, Colorado. . .Scientists at the High Altitude Observatory of the National Center for Atmospheric Research (NCAR) here are going into high-gear on preparations for next spring's Skylab launch. Skylab is an experimental space station--a 100-ton complex of highly versatile experiments with capabilities for multipurpose scientific investigation unmatched by any institution on Earth. Its three-man crews, rotated every 90 days, will carry out more than 50 major research programs developed by scientists, and specialists of universities, observatories, medical schools, hospital and health institutions, and other public and private agencies in the United States and abroad.

Along with the other experiments, six solar telescopes are mounted on Apollo Telescope Mount (ATM) which, with the astronauts, comprise the first manned scientific observatory in space. ATM is a major component of Skylab and is a solar observatory designed to observe, monitor, and record the day-to-day structure and behavior of the Sun as well as document any solar flare activity.

Dr. Robert M. MacQueen, scientist at HAO, explains:

> "This is a solar observatory whose equal has never existed. ATM, tucked in the cone-shaped nose of the launch vehicle and later deployed in space, will view a large portion of the spectrum of light generated by the Sun. The experiments aboard ATM were designed for collaborative research by the Naval Research Laboratory, Marshall Space Flight Center, Harvard College Observatory, American Science and Engineering, and NCAR's High Altitude Observatory (HAO)."

The opportunity to coordinate observations with ATM experimenters will be extended to all the world's scientists by daily broadcasts of ATM's planned observing schedules over WWV, the NBS time standard radio station.

The White Light Coronagraph installed on the ATM was designed at HAO under NASA contract and built by Ball Brothers Research Corporation. It uses an external device to block out or occult the face of the Sun. It then can monitor the

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brightness, form and polarization of the solar corona from 1.5 to 6 solar radii in the 4000 to 6000 angstrom range.

The regions on the Sun where the gaseous solar atmosphere forms streamers and other elevated structures have been high-lighted by dramatic eclipse photos but such photos give solar physicists only a brief glimpse of the coronal configuration. These occasional glimpses, at least six months apart, are unrelated to one another and yield little information about the day-to-day structure of the intermediate and outer regions of the Sun's corona. By contrast, the ATM will observe every 12 hours for eight solar rotations.

Numerous questions and problems have been defined but not solved by past research. They include questions such as: What is the three-dimensional structure and form of coronal streamers? What is the correlation between the formation and temporal evolution of streamers and surface features? What is the spatial variation of the solar wind in the corona? What are the optical counterparts of the various coronal radio bursts and what mechanism triggers them?

The structure of the corona is clearly connected to the behavior of the solar surface. Even a quiet region on the Sun does not have a uniform distribution of velocity, magnetic field, or temperature. The inhomogenities are increased in and around active regions. Any exact relationships between coronal features, sites of surface activity, and the solar wind that flows past the earth remain mysteries.

Present earth-bound views of the Sun have a resolution of areas about the size of the state of Colorado (at best) because of the problems involved in viewing celestial objects through the "veil" of Earth's atmosphere. In addition, the terrestrial atmosphere strongly absorbs X-rays and ultraviolet radiation, making it imperative to get above the atmosphere to observe these portions of the solar spectrum.

HAO's white light coronagraph experiment, dubbed the WLCE, was designed to gather observations needed to better understand the physics of the solar corona. Synoptic observations of the solar corona from the vantage point of space will provide a history of photographs and observations of coronal brightness and polarization that spans the mission. Such a detailed, time-consistent history is unprecedented. The WLCE will also observe transient coronal events associated with coronal radio bursts and solar activity. To do this, of course, requires rapid

response to news of a solar flare or eruptive event on the Sun. When a flare occurs, the entire ATM observing program will be switched to a different mode.

Dr. Ernest Hildner, of HAO, explains:

> "If a flare occurs far from the limb or edge of the Sun, it is unlikely that the WLCE will be able to observe its coronal consequences. But, for a flare near or on the limb, we hope to observe the response of the corona to the sudden release of so much energy in the chromosphere. The ATM will be pointed at the limb flare until the flare decays; then the pointing will be shifted to the center of the Sun so that the WLCE can observe the corona. These observations should show how the reconnection of magnetic fields, theoretically assumed to accompany a flare, propagates upward into the corona. The extreme heating and the movement of field lines which occur at the site of the flare will induce material motions. We'd like to know if these motions are damped or accelerated as the material moves upward. We hope to observe how solar conditions determine the answer to this question. Also, radio bursts are observed to accompany some, but not all flares. We hope to determine what set of coronal conditions is conducive to radio burst production and why."

Along with Drs. MacQueen and Hildner, members of the HAO staff working on the WLCE are John T. Gosling, Arthur I. Poland, Richard M. Munro, Charles L. Ross, and Nancy J. Martin. NCAR is operated by the University Corporation for Atmospheric Research and sponsored by the National Science Foundation.

Thus, solar physics takes its place among the many scientific disciplines expected to benefit from Skylab---medicine, chemistry, meteorology, ecology, systems engineering, and astronomy.

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